CLAIMS

1. A method for generating X-ray or EUV radiation, comprising the steps of:

(i) forming a target jet by urging a liquid substance under pressure through an outlet opening, the target jet propagating through an area of interaction, and

(ii) directing at least one electron beam onto the target jet in the area of interaction such that the electron beam interacts with the target jet to generate X-ray or EUV radiation.

2. A method according to claim 1, wherein the substance comprises a solid material, heated to a liquid state.

3. A method according to claim 2, wherein the solid material is a metal.

4. A method according to claim 1, wherein the substance comprises a gas, cooled to a liquid state.

5. A method according to claim 4, wherein the gas is a noble gas.

6. A method according to claim 1, wherein the electron beam interacts with the jet at a distance from about 0.5 mm to about 10 mm from the outlet opening.

7. A method according to claim 1, further comprising the step of:

(iii) controlling the electron beam to interact with the jet at an intensity such that Bremsstrahlung and characteristic line emission is generated in the hard X-ray region, essentially without heating the jet to a plasma-forming temperature.

8. A method according to claim 1, further comprising the step of:

(iii) controlling the electron beam to interact with the jet at an intensity such that the jet is heated to a plasma-forming temperature, such that soft X-ray radiation or EUV radiation is generated.

9. A method according to claim 1, wherein the target jet is in a solid state in the area of interaction.

10. A method according to claim 1, wherein the target jet is in a liquid state in the area of interaction.

11. A method according to claim 10, wherein the electron beam interacts with at least one droplet in the area of interaction.

12. A method according to claim 10, wherein the electron beam interacts with a spray of droplets or clusters in the area of interaction.

13. A method according to claim 1, wherein the electron beam interacts with a spatially continuous portion of the target jet in the area of interaction.

14. A method according to claim 1, wherein the electron beam is focused on the target jet to essentially match a transverse dimension of the electron beam to a transverse dimension of the jet.

15. A method according to claim 1, wherein the target jet is formed with a diameter from about 1 μm to about 10,000 μm.

16. A method according to claim 1, wherein the electron beam is generated by means of an acceleration voltage

from about 5 kV to about 500 kV and an average beam current from about 10 mA to about 1000 mA.

17. A method according to claim 1, wherein at least one pulsed electron beam is directed onto the target jet.

18. A method according to claim 1, wherein at least one continuous electron beam is directed onto the target jet.

19. A method according to claim 1, further comprising the step of performing a medical diagnosis with the X-ray or EUV radiation.

20. A method according to claim 1, further comprising the step of performing non-destructive analysis with the X-ray or EUV radiation.

21. A method according to claim 1, wherein EUV radiation is generated, and further comprising the step of performing EUV projection lithography with the EUV radiation.

22. A method according to claim 1, further comprising the step of performing crystal analysis with the X-ray or EUV radiation.

23. A method according to claim 1, further comprising the step of performing microscopy with the X-ray or EUV radiation.

24. A method according to claim 1, wherein X-ray radiation is generated, and further comprising the step of performing X-ray diffraction with the X-ray radiation.

25. A method according to claim 24, wherein the X-ray diffraction is performed for the purpose of protein structure determination.

26. A method for generating hard X-ray radiation, comprising the steps of:

(i) forming a target jet by urging a liquid substance under pressure through an outlet opening, the target jet propagating through an area of interaction,

(ii) directing at least one electron beam onto the target jet in the area of interaction such that the electron beam interacts with the target jet to generate X-ray or EUV radiation, and

(iii) controlling the electron beam to interact with the target jet at an intensity such that Bremsstrahlung and characteristic line emission is generated in the hard X-ray region, essentially without heating the jet to a plasma-forming temperature,

wherein the electron beam is generated by means of an acceleration voltage from about 5 kV to about 500 kV and an average beam current from about 10 mA to about 1000 mA.

27. A method for generating soft X-ray or EUV radiation, comprising the steps of:

(i) forming a target jet by urging a liquid substance under pressure through an outlet opening, the target jet propagating through an area of interaction,

(ii) directing at least one electron beam onto the target jet in the area of interaction such that the electron beam interacts with the target jet to generate X-ray or EUV radiation, and

(iii) controlling the electron beam to interact with the jet at an intensity such that the target jet is heated to a plasma-forming temperature, such that soft X-ray radiation or EUV radiation is generated,

wherein the electron beam is generated by means of an acceleration voltage from about 5 kV to about 500 kV and an average beam current from about 10 mA to about 1000 mA.

28. An apparatus for generating X-ray ot EUV radiation, comprising a target generator arranged to form a target jet by urging a liquid substance through an outlet opening, the target jet propagating towards an area of interaction, and an electron source for providing at least one electron beam and directing the at least one electron beam onto the jet in the area of interaction, said radiation being generated by the electron beam interacting with the jet.

29. An apparatus according to claim 28, wherein the substance comprises a solid, heated to a liquid state.

30. An apparatus according to claim 29, wherein the solid is a metal.

31. An apparatus according to claim 28, wherein the substance comprises a gas, cooled to a liquid state.

32. An apparatus according to claim 31, wherein the gas is a noble gas.

33. An apparatus according to claim 28, wherein the electron source is controllable to direct the electron beam onto the target jet at a distance from about 0.5 mm to about 10 mm from the outlet opening.

34. An apparatus according to claim 28, wherein the electron source is controllable to effect interaction of the electron beam with the target jet at an intensity of the electron beam such that Bramsstrahlung and characteristic line emission is generated in the hard X-ray region, essentially without heating the jet to a plasma-forming temperature.

35. An apparatus according to claim 28, wherein the electron source is controllable to effect interaction of the electron beam with the target jet at an intensity of the electron beam such that the jet is heated to a plasma-forming temperature, whereby soft X-ray radiation or EUV radiation is generated.

36. An apparatus according to claim 28, wherein the target generator is controllable to provide condensed matter in the area of interaction.

37. An apparatus according to claim 28, wherein the target generator is controllable to provide a spatially continuous portion of the jet, at least one droplet, or a spray of droplets or clusters in the area of interaction.

38. An apparatus according to claim 28, wherein the electron source is controllable to essentially match a transverse dimension of the electron beam to a transverse dimension of the jet by focusing the electron beam on the jet.

39. An apparatus according to claim 28, wherein the target generator is adapted to generate the jet with a diameter from about 1 μm to about 10,000 μm.

40. An apparatus according to claim 28, wherein the electron source is controllable to generate the electron beam by means of an acceleration voltage from about 5 kV to about 500 kV, and wherein the electron beam has an average beam current from about 10 mA to about 1000 mA.

41. An apparatus according to claim 28, wherein the electron source is controllable for generation of at least one pulsed electron beam.

42. An apparatus according to claim 28, wherein the electron source is controllable for generation of at least one continuous electron beam.

43. An apparatus for generating hard X-ray radiation, comprising a target generator arranged to form a target jet by urging a liquid substance under pressure through an outlet opening, the target jet propagating towards an area of interaction, and an electron source for providing at least one electron beam and directing the at least one electron beam onto the jet in the area of interaction, said radiation being generated by the electron beam interacting with the jet,

wherein the electron source is controllable to effect interaction of the electron beam with the jet at an intensity of the electron beam such that Bramsstrahlung and characteristic line emission is generated in the hard X-ray region, essentially without heating the jet to a plasma-forming temperature, and

wherein the electron source is controllable to generate the electron beam by means of an acceleration voltage from about 5 kV to about 500 kV, and wherein the electron beam has an average beam current from about 10 mA to about 1000 mA.

44. An apparatus for generating soft X-ray or EUV radiation, comprising a target generator arranged to form a target jet by urging a liquid substance under pressure through an outlet opening, the target jet propagating towards an area of interaction, and an electron source for providing at least one electron beam and directing the at least one electron beam onto the jet in the area of interaction, said radiation being generated by the electron beam interacting with the jet,

wherein the electron source is controllable to effect interaction of the electron beam with the jet at an intensity of the electron beam such that the jet is

heated to a plasma-forming temperature, whereby soft X-ray radiation or EUV radiation is generated, and

wherein the electron source is controllable to generate the electron beam by means of an acceleration voltage from about 5 kV to about 500 kV, and wherein the electron beam has an average beam current from about 10 mA to about 1000 mA.